Universal Aggregates Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash

Benefits Presentation

Power Plant Improvement Initiative

New Recycling Technology Producing Aggregate for Masonry, Concrete and Paving

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Outline

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  - Manufactured Aggregate Process
  - Schematic
  - Advantages
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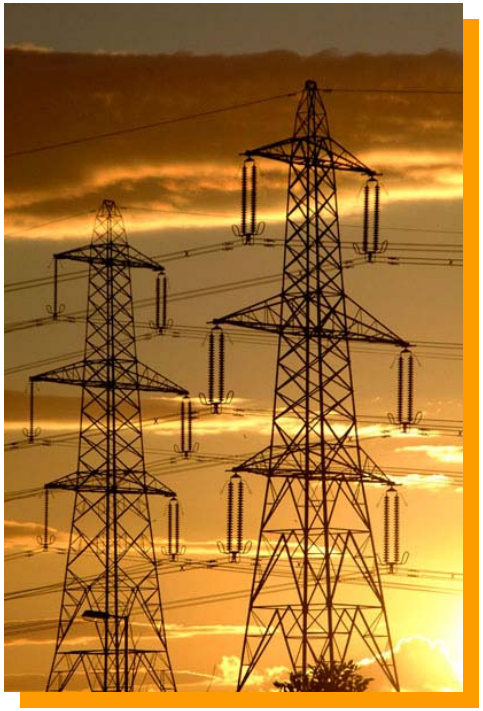

Outline (continued)

- **Estimated Benefits**
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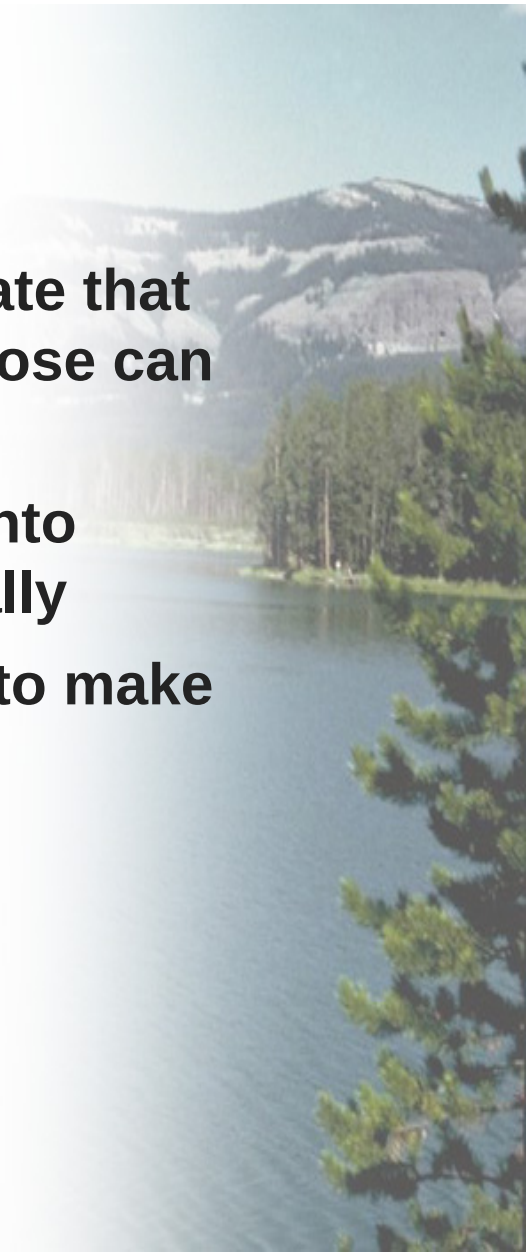
Executive Summary



- **Universal Aggregates, LLC will demonstrate that a waste material with little beneficial purpose can be turned into useful products**
- **115,000 tons of spray dryer by-products into 167,000 tons lightweight aggregate annually**
- **Aggregate from the process can be used to make a variety of construction materials**
  - Masonry block
  - Lightweight concrete
  - Asphalt paving material

Project Information
Plant, Location, and Cost

- **Universal Aggregates, LLC project at 250 MW Birchwood Power Facility in King George County, Virginia**
- **Project cost: $19.6 million (DOE share: $7.2 million)**

Project Information (continued)
Team Members, and Schedule

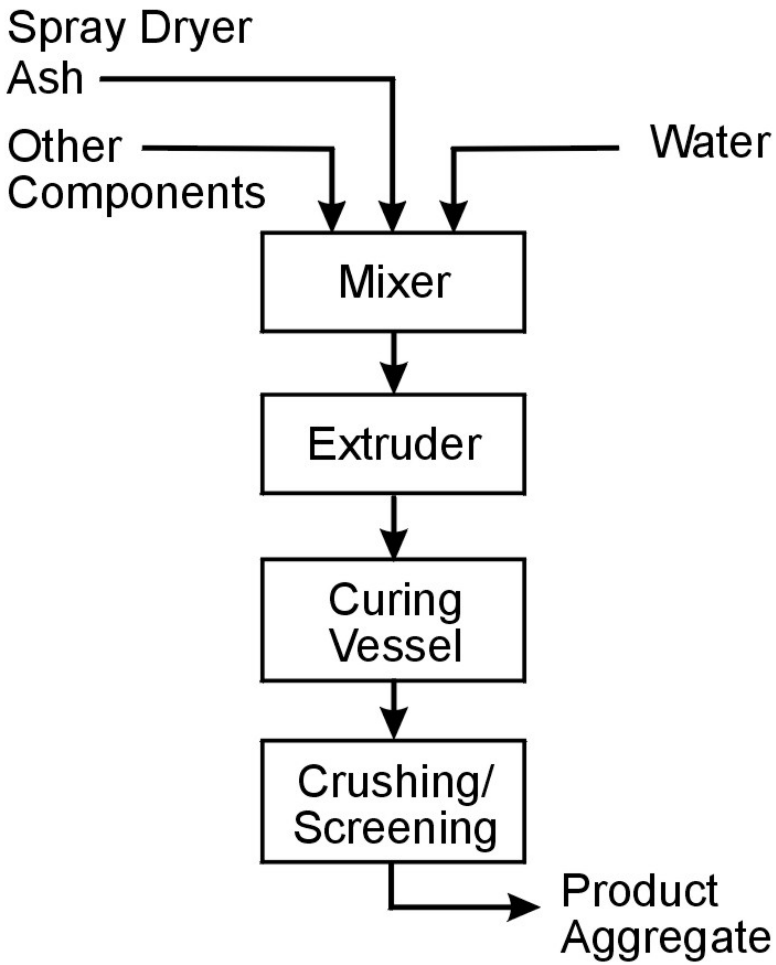
- **Team members Include:**
  - SynAggs, LLC (Pittsburgh, PA)
  - P.J. Dick, Inc. (Pittsburgh, PA)
- **Schedule:**
  - 2002 Project Start
  - 2004 - 2006 Operation
  - 2006 Completion

Project Information (continued)
Manufactured Aggregate Process

- Spray dryer ash, recycle solids (from either wet or dry scrubbers), and water are thoroughly combined to generate a uniform blended granular mixture
- An extrusion system is used to intensify mixing and shearing of blended granular mixture and compact the granular mixture into a solid form
- Newly formed extrusions are then coated with additional spray dryer ash and conveyed to curing vessel
- Extrusion material is then cured in an adiabatic thermal process then crushed and screened to appropriate size gradations for construction applications

Project Information (continued)

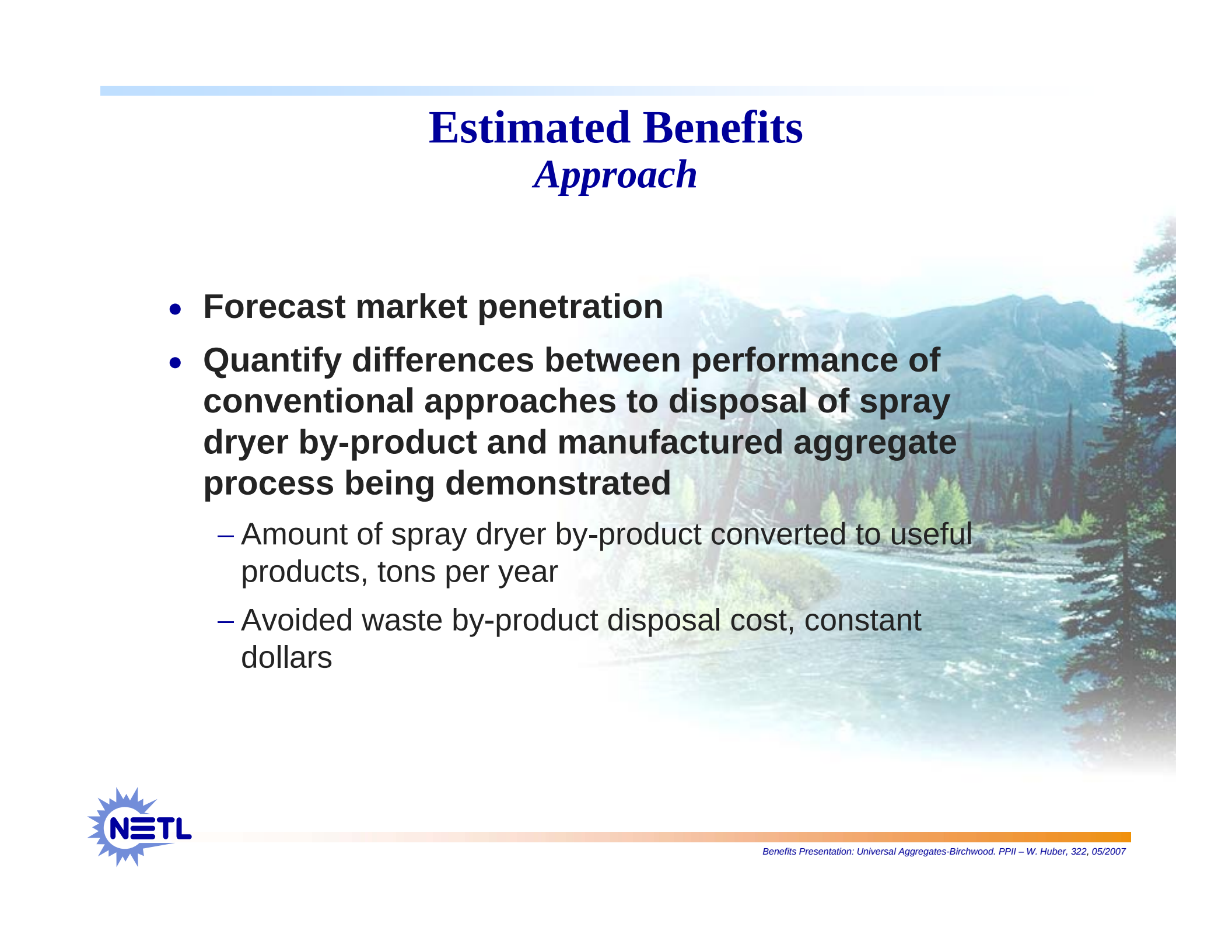
Universal Aggregates Simplified Process Schematic



Project Information (continued)
Unique Contribution

- **This technology offers an alternative to disposing of spray dryer waste by landfilling**
  - Avoidance of waste by-product disposal costs, which vary from $2-$30/ton
  - Lower environmental impact; less scrubber by-product to landfill and less aggregate rock to mine
- **Lightweight manufactured aggregate can be sold to concrete block manufactures for profit**
- **Manufactured aggregate concrete blocks meet or exceed ASTM specifications, including compressive strength**
- **Technology can be used in areas with high construction material demand but limited access to natural aggregate**

Estimated Benefits
Approach



- **Forecast market penetration**
- **Quantify differences between performance of conventional approaches to disposal of spray dryer by-product and manufactured aggregate process being demonstrated**
  - Amount of spray dryer by-product converted to useful products, tons per year
  - Avoided waste by-product disposal cost, constant dollars

Estimated Benefits (continued)
Market Penetration Assumptions

- **Individual boilers with spray dryer Flue Gas Desulfurization (FGD) facilities were identified by the participant. Market size was confirmed using NETL's Coal Power Data Base**
- **Specific attributes used to determine generation facilities with greatest potential for manufactured aggregate sales are:**
  - Forecast of significant market for manufactured aggregate
  - Boilers equipped with spray dryer facilities
  - Generating units with high waste disposal costs
  - Location in areas with high construction material demand and limited access to natural aggregate

Birchwood Power Facility Storage Silo for Spray Dryer By-product.

Estimated Benefits (continued)
By-Product Reductions from Commercialization

By-Product Utilization	Birchwood Power Facility	National Target Market
Spray Dryer By-Product Utilization, Tons per year	115,000	1,722,000
Estimated Avoided Lifetime By-Product Disposal, Tons	2,300,000	24,850,000
Estimated Avoided Lifetime By-Product Disposal, Cost	$12,000,000	$124,250,000

Estimated Benefits
Capital Cost

- **Processing fee for disposal of spray dryer byproduct is estimated to be $5 per ton of byproduct over lifetime of project**
- **Total avoided processing fee for commercialization throughout nation is based upon construction of one manufactured aggregate plant per year over a 13 year period**

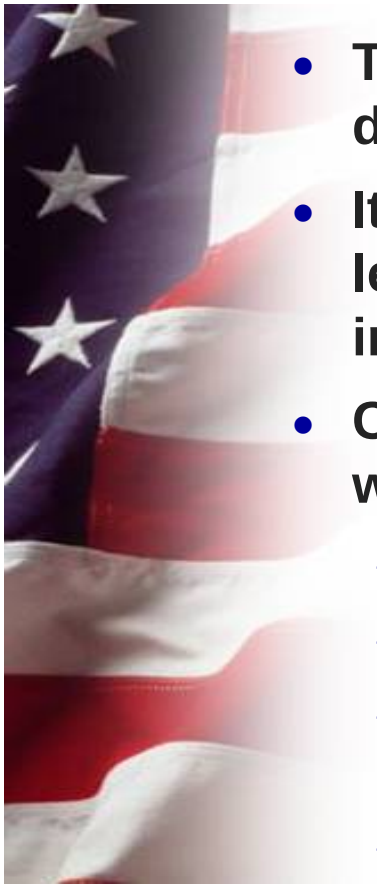
Aerial View of the Universal Aggregates Manufacturing Plant in King George, Virginia

Estimated Benefits (continued)
Regional

- **Plant will no longer pay annual disposal costs on over 100,000 tons of spray dry waste each year**
- **This demonstration is the first step to verify aggregate manufacturing process**

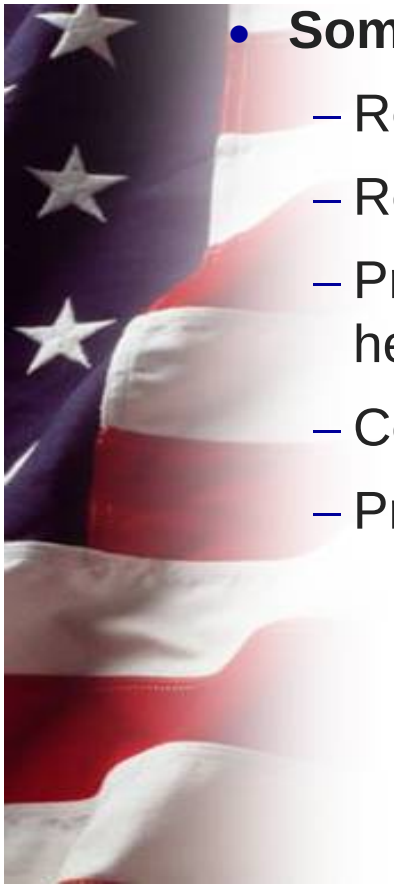
250 MW Birchwood Power Partners

Estimated Benefits (continued)
National



- **There are currently 21 spray dryer units producing this difficult to use by-product material**
- **It is anticipated that, if proposed multipollutant control legislation is enacted, many more spray dryers will be installed to control SO_2 emissions**
- **Commercialization of manufactured aggregate process will:**
  - Reduce environmental impact
  - Lower FGD waste by-product disposal costs
  - Generate aggregate meeting or exceeding ASTM specifications for construction materials
  - Produce sales of a former waste by-product

Estimated Benefits (continued)
National



- **Some additional benefits:**
  - Reduce toxic release inventory reporting
  - Reduce cost of process water discharge
  - Process supports Clean Air Act Regulations, and public health
  - Conserves energy usage
  - Provides manufacturing jobs

Conclusions

This Technology

- **Lowers waste by-product disposal cost**
- **Reduces environmental impact**
  - Lowers landfilling liability
  - Less scrubber sludge to landfill
  - Less aggregate rock to mine
- **Produces aggregate that meets or exceeds ASTM specifications for construction materials**

Conclusions (continued)

- Enables sales of former waste sludge
- Reduces cost of consumer electric bills
- Commercial application could transform ~25 million tons of spray dryer waste into useful aggregate

Visit the NETL web site for information on all Power Plant Improvement Initiatives and Clean Coal Power Initiative projects

www.netl.doe.gov/technologies/coalpower/cctc